Postgraduate Research Scholarship in Plasma Engineering

Project Descriptions

Project 1: Cold Plasma Interactions with Microbial Biofilms

This project will explore the use of cold plasma and cold-plasma activated liquid as a tool for treating microbial biofilms. The mode of action and molecular mechanisms for plasma induced effects on microbial cells and the biofilm matrix will be investigated. Additionally, the possible use of cold plasma in synergy with existing strategies, for example antibiotics or nanoparticles will be studied.

Project eligibility:

- Applicants must hold an Honours Degree or a Master’s degree, or equivalent in a relevant subject such as microbiology or molecular biology.

Project 2: Plasma Driven Gas Conversion

The largest human influence on global warming is the emission of greenhouse gases (GHG) such as carbon dioxide, methane, and nitrous oxide. Innovative solutions could convert GHGs into useful products. The combination of atmospheric plasma and heterogeneous catalysts offers a potential solution for GHG conversion, nitrogen fixation and hydrocarbon chemistry. The use of plasma in combination with solid catalysts has the potential to enhance the conversion of feed gases, improve the selectivity and to reduce the operating temperature which improves energy efficiency and can improve catalyst stability reducing poisoning, coking and sintering. Non-thermal plasmas create a large amount of vibrational species which offer the promise of low temperature plasma catalysis of stable molecules. The goal of this PhD position is to design and test plasma-catalysis reactors for high-yields of CO2 reductions with refined catalyst materials to overcome the energy barriers currently limiting gas conversion.

Project eligibility:

- Applicants must hold an Honours Degree or a Master’s degree, or equivalent in a relevant subject such as chemical engineering.

Project 3: Atmospheric Plasma for Water Treatment

Water quality is one of the main global challenges facing humanity, threatening human health, limiting food production, reducing ecosystem functions, and hindering economic growth. There is an need for sustainable water management and innovative treatment technologies for water security. Advanced water treatment technologies are required to meet the growing concerns regarding emerging water pollutants, such as pesticides, antibiotics and pharmaceuticals. Atmospheric air plasmas are gaining increasing attention as an advanced oxidation process (AOP) for water purification, generating a host of reactive species that attack and ultimately mineralise contaminants. This project will address key challenges of scaling the technology and validation of
process efficacy for a range of contaminants. The potential to combine the technology with suitable catalysts will be studied.

**Project eligibility:**

- Applicants must hold an Honours Degree or a Master’s degree, or equivalent in a relevant subject such as chemical engineering.

**Project 4: Atmospheric Plasma for Biomass Conversion**

Lignocellulosic biomass is currently an undervalued material. However, such biomass presents an attractive but challenging substrate for bioethanol and other bio-based products production. The challenge is that the fermentable sugars for such biomass are trapped inside the cross-linking structure of lignocellulose, requiring pre-treatment processes to convert it from its native form into a form amenable to biodegradation. Atmospheric plasma technology is an emerging and green technology for such pre-treatment. This project will develop, test and scale innovative plasma driven technologies to convert waste biomass into valuable products.

**Project eligibility:**

- Applicants must hold an Honours Degree or a Master’s degree, or equivalent in a relevant subject such as chemical engineering.

**Project 5: Plasma Additive Manufacturing**

Additive manufacturing, also known as 3D printing, is a process that creates physical objects from a digital design. The potential exists to combine the reactive physics and chemistry induced by atmospheric plasmas with the individual building blocks of the printing process to provide unique functional structures. This project will integrate innovative atmospheric pressure plasma reactors with 3D printing processes to build and test novel functionalised structures for a range of applications from sensors to catalysts.

**Project eligibility:**

- Applicants must hold an Honours Degree or a Master’s degree, or equivalent in a relevant subject such as chemical engineering.

**For further information, please contact:**

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